

NOTES AND THOUGHTS ON...

Soils Site Investigation At Jefferson Patterson Park, King's Reach Quarter - Puncheon building
February 3, 2000
Susan L. Davis

Participants:

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Observations:

We looked at the soil profile in a pit excavated to uncover a portion of the trench in which the poles were set for the puncheon building.

Landscape: I would characterize the field and surrounding area as an ancient terrace of the Patuxent River. It would be the second terrace. Its aspect was nearly due west. Elevation was approximately 120 feet (?) The site observed was about at the toe of the adjacent upland slope. The lower back slope, foot slope and toe slope are gradual (all are B slopes on the soil survey). The upper back slope and shoulder slope are steeper, mapped E slopes. The field in which the site was located was bounded by hedge rows, with about 300 feet between the hedgerows. The trees in the hedgerows appeared to be well under 100 years old, with the exception of a few oaks.

The A horizon in the pit was thick and dark, with oyster shell fragments concentrated in the lower portion of the A horizon.

Field kit measured pH was 7.5 to 8 throughout the A and B horizons exposed.

Earthworms were rampant, and their activity was evident throughout the A and upper Bt.

The color of the A was uniform throughout.

Signs of clay illuviation (movement) were present in the upper B horizon, in a zone full of faunal pedoturbation. Faint to distinct clay films and few distinct clay bridges between sand grains were seen at the base of the A/top of the B (due to the silty nature of the soil material, there were very few sand grains to be seen). There were a few faint clay films and clay bridged sand grains in the lower A horizon (the portion with shell fragments).

Structure of the A horizon was moderate to strong fine and medium granular. There seemed to be a slight increase in aggregate stability with depth. This could be examined more closely using some of the 'Soil Quality' testing methods. Earthworm casts were common to many, perhaps upwards of 40% burrows and casts. This may be artifact of the pit being covered by black plastic, which would bring the worms to the pit faces and enhance winter activity.

The soil was mapped Matapeake, and except for the overly thick A and the high pH the profile fit Matapeake to the depth observed, however I did not look deep enough to determine the drainage class or the nature of the lower Bt, BC or C horizons.

A quick auger boring further upslope, in a footslope position showed a thinner, redder, less dark Ap horizon of a loam texture with no shell fragments.

Interpretations:

The entire profile has been affected by the higher base status, to the depth observed. The soil solution has been high in calcium due to the dissolution of the shell fragments from the midden. With calcium in the soil solution in the A horizon calcium humates would have formed. Calcium humates would impart the darker (than usual for MD coastal plain A horizon) soil organic material, more resistant to decomposition in the course of tillage. The good aggregate stability could also be due in part to the calcium humates.

Earthworm activity is expected to be higher in a soil with higher base saturation, particularly one with high calcium content because earthworms have an affinity for calcium. I think that the uniform color of the Ap and lower A (A2) is a result of active faunal pedoturbation (bioturbation)

Increase in strength of the structural units with depth, together with the evidence of clay movement in the lower A horizon point to little disturbance of the lower A and upper B by humans in the recent past (in the area examined). Tillage, particularly moldboard plowing, tends to enhance the decomposition of organic matter, and subsequently weakens the structural units in the A horizon.

Clay illuviation is a slow process that may take hundreds or thousands of years to develop visible signs such as distinct clay films and clay bridging. Signs of clay illuviation in the A horizon are not common in soils such as Matapeake which are typically formed in calcium poor sediments under forest vegetation, and therefore have a thin A horizon. Considering this, I guess that the lower A horizon and the upper Bt horizon in the area observed have not been significantly disturbed, even when the trench was dug for the building. Another thing that makes the visible signs of the clay movement even more remarkable is the evidence of significant earthworm pedoturbation. The worms' constant churning and the soil passing through their gut tend to obscure clay films and clay bridging.

The high pH throughout the profile does not give much information on the timing of the development of the thick a horizon. Agricultural practices have been shown to raise the soil pH deep in the profile in 10's to 100 or 200 years - a relatively short period of time. We assume that the shells have been present for 100's if not 1000's of years, so it is not surprising that the pH is high in the B horizon.

The landscape position of the site makes it appear a likely candidate for deposition, both eolian and colluvial. The prevailing NW winds, or winds off of the river, where there is a substantial

fetch, may travel across the lower terrace, then be forced up slope. The site we were looking at was behind, or on the leeward side of, a small rise at the windward edge of the second terrace. If you think of a sand dune, this leeward edge would be where the wind would drop some of its load of soil particles after rising up the dune and losing energy. Deforestation and cultivation of this field, together with periodic drought left its topsoil subject to erosive forces. Silty material which is low in clay (this describes the Matapeake A horizon) is easily picked up by wind when particularly when it is dry and there is no plant or snow cover. The soil movement within a bare field can be substantial, even in one year. Imagine a drought year such as we had this year, moldboard plowing, little crop residue or weed cover (due to drought), and a strong wind from the west or northwest, and you would have an ideal scenario for wind erosion moving tons of material.

Wind scour patterns on the first terrace, (or possibly warmer and drier conditions) were displayed to casual observation of the snow cover. The edge of the first terrace was bare of snow, while the leeward side of the small rise at the edge of the second terrace had drifted snow at least 10 inches deep. Topsoil has probably been moving in a similar manner to the snow. (Even if the lack of snow on the first terrace is attributed to warmer and drier conditions, this micro climatic difference would probably hold true in the summer, and the soils may be drier, and therefore more likely to be eroded by wind.)

Because there is a shell midden on the first terrace, too, any silt moved by the wind from the first terrace to the second terrace in this field would probably have similar color, pH and calcium content to the material already present as topsoil on the second terrace.

If the building whose foundation is being excavated stood abandoned or little used, or if the people using the building were untidy I can imagine wind blown silt off of the first terrace piling up on the windward side of the building, or beneath it if there was a raised floor.

Because the site is in a toe slope position, it is also likely to have received water borne sediment deposition, too. Kirsti witnessed a runoff event supporting this conjecture. It is supported by the observation of the thinner, less dark, sandier topsoil in the field upslope. I envision that this erosion and redeposition by wind and water, which I just discussed, to have taken place primarily after the initial clearing and cultivation of the field, and continue periodically until soil conservation practices were employed.

By the looks of the landscape position of the site we observed, these two types erosive forces would both drop a portion of their sediment load at our site. This is my explanation of the irregular distribution of the shell fragments in the A horizon. The erosive agents, particularly the wind, would not carry the heavier, coarser shell fragments. Therefore the material deposited recently would not have the shell fragments that we see in the lower part of the A horizon. This makes it appear that the surface of the pre-deposition A horizon might have been about where the shell fragments begin. Recent tillage has therefore probably taken place only in the upper 6 to 11 inches of the A horizon. The plow zone would have migrated upwards with the deposition, however. The oldest signs of tillage may be deeper than 6 to 11 inches from the current surface due to this accretion. The excellent tilth of the soil makes it seem unlikely that any recent farmer

would have "ripped", "subsoiled", or chisel plowed deeply, even with the advent of greater tractor power.

All of the above interpretations are based on our observations and discussion. The conjecture is based on those observations and discussion together with my understanding of soil forming processes. I add these remarks by way of a disclaimer. Another soil scientists may look at the same evidence, and arrive at different conclusions (they say that if you show three soil scientists the same pit you get four different, strongly held opinions). In the normal course of our technical services and site investigations that we provide to our customers we try to restrain ourselves to interpretations based on the published soil surveys. This site investigation goes beyond the scope of interpretations provided in the soil survey. Another result of this is that I can give you no concrete references for citation.

S. L. Davis 2/8/00